

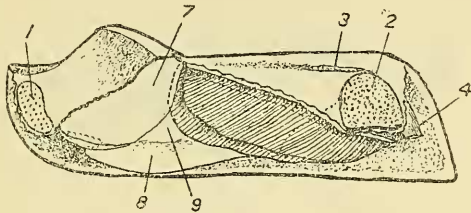
50. On the Anatomy of *Scaphula*, Benson, with a description of a new Species. By EKENDRANATH GHOSH, M.Sc., M.D., F.Z.S., F.R.M.S., Professor of Biology, Medical College, Calcutta.

[Received June 19, 1922: Read November 21, 1922.]

(Text-figures 1-7.)

The Lamellibranch genus *Scaphula*, Benson is represented by three species from the rivers of India and Burma. The anatomy of all the known species is unknown to science, with the exception of the gills of an undetermined species from Siam (Ridewood, Philosophical Transactions, Ser. B, vol. 195). The present paper aims at describing the characteristic soft parts of the genus, based upon the animals of *S. celox*, Benson, and of a new species from Siam. The specimens were received from the Zoological Survey of India, through the kindness of Dr. N. Annandale.

Text-figure 1.



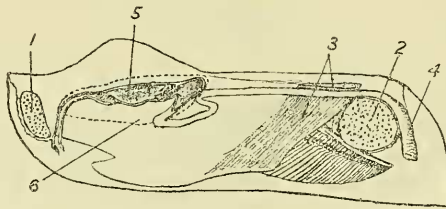
Animal of *S. celox*, side view (left).  $\times 10$ .

The body is elongated, being two to three times as long as it is deep, and deeper posteriorly than anteriorly. The median dorsal margin is a third to a quarter less than the body-length. The anterior adductor muscle is much smaller than the posterior. Both the anterior and posterior margins slope backwards. The anterior adductor muscle is narrow and elongated at its insertion, and is placed rather close to the anterior margin. The length of the area of insertion is parallel to the latter. The posterior adductor muscle is large at its insertion and may be oval or triangular in shape. It is placed a little distance from the posterior margin. The foot is elongated and compressed laterally; it presents a shallow fissure along the mid-ventral line. The foot is perhaps capable of slight expansion round the fissure. A minute byssus cavity is present in the ventral fissure towards the posterior end of the foot. The byssus is not well developed, being in the form of fine silky threads in the Siamese species. An obtusely-pointed process is present at the postero-ventral aspect

of the foot. The anterior retractor pedis muscle is narrow and elongated, and consists of two heads of insertion into the valve. The posterior retractor pedis muscle is narrow, and elongated at its insertion into the valves just in front of the posterior adductor muscle. It extends diagonally from the posterior end of the foot.

The visceral mass is greatly widened out laterally into a somewhat conical hump with an oblique ridge on the surface. The gills are elongated, tapering posteriorly, and are about half the length of the body and thrice as long as broad. The gill-axis is slender, rod-like, and is placed more horizontally than diagonally and ends in a small free posterior portion. The gill-filaments are placed obliquely to the gill-axis, and the reflected filaments are free dorsally. The labial palps are elongated, semilunar in shape, and are placed at an obtuse angle with the gill-axis. They are one-third to one-fourth the length of the body, and twice as long as broad. The œsophagus is curved, with the concavity directed backwards. The stomach is greatly elongated. The cæcum of

Text-figure 2.

Animal of *S. celox*, longitudinal section.

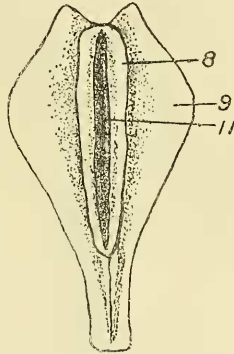
the crystalline style is small, narrow, and is fused with the beginning of the intestine, the latter being placed on the right side of the cæcum. The intestine consists of a short anterior and a long posterior limb, and is placed towards the right side of the body. The rectum is placed dorsally to the heart, and ends in a small free portion projecting downwards and backwards from the posterior surface of the posterior adductor muscle. The pericardium is divided into two lateral portions. The two ventricles are widely separated from each other by a narrow tube, which gives rise to anterior and posterior aortæ. The auricles are comparatively large; they do not communicate with each other. The digestive glands are extensive. The genital organs surround the lower portion of the œsophagus and occupy the ventral region of the visceral mass. Oosphradia and Thiele's abdominal sense-organs are both absent.

*Structure of the Gills of S. celox.*—The gill-filaments are flattened antero-posteriorly as usual. There are no interlamellar extensions (described in *Arca pexata* by Kellogg (Bull. U.S. Fish

Comm. 10, 1890) and in *Arca americana* by Ridewood, *l. c.* p. 199), but interlamellar septa (present in both the above species) are present, extending to about one-fourth or one-fifth the height of the filament. The ciliary discs seem to be present only at the free ends and at the junctions of the direct and reflected filaments. They are much more numerous in all the other known genera and species of the Arcidæ, being arranged in many horizontal rows. The arrangement of the cilia could not be followed distinctly. The frontal cilia do not seem to extend much on the anterior and posterior faces of the filaments. The lateral ciliary rows are placed a little distance behind the frontal row. The chitinous lining is uniformly thin.

The gills of the species of *Scaphula* from Siam could not be studied. Ridewood notes in species from Siam (the present species?) one horizontal row of ciliary disc to the descending filament and one to three such rows in the ascending one.

Text-figure 3.



Ventral view of the foot and visceral mass of *S. celox*.

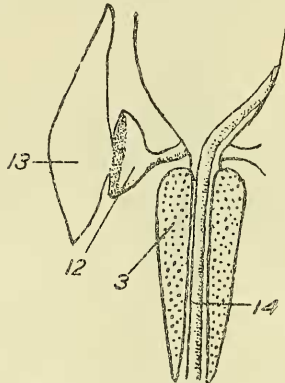
*Remarks.*—The genus *Scaphula* Benson belongs to the family Arcidæ. It was recognized as such by Gray (*Ann. & Mag. Nat. Hist.* xix.), and by Adams and Adams (*Gen. Recent Moll.*). Fischer (*Man. Conch.*) makes it a subgenus of *Arca*, and places it in the middle of his list. Dall (*Trans. Wagner Free Institute of Science*, iii. pt. 4) makes it a group in the subgenus *Barbatia*. Pelseener (*Lankester's Treatise on Zoology*, v.) raises it to a genus, and places it near the genus *Arca*. Lamy (*Journ. Conchyliol.* lv.), in his revision of the genus *Arca*, considers it a subgenus, and places it near the subgenera *Arca*, *Barbatia*, *Acar*, *Fossularca*, and *Parallelepipedum*.

The body of the animal is characterized by an antero-posterior elongation, perhaps correlated with the inequality in the size of the adductor muscles. The elongation of the body has also affected the visceral mass and the foot to a relatively less extent. But

the shape, size, and the position of the anterior adductor muscle may have something to do with the atrophy\* of the extreme anterior region of the body. The poor development of the byssus apparatus and the absence of sense-organs are probably examples of degeneration due to its fluviatile life.

The animal of *Scaphula* agrees more with the animals of *Byssarca* Swainson, *Barbatia* Gray, and *Acar* Gray than those of the other genera of the Arcidæ in its great antero-posterior elongation and in the inequality in size of the adductor muscles. It further resembles the first two, especially in the widening of the body from side to side, and in the great disparity of the adductor muscles in size. But the foot and the visceral mass are strongly affected in the present genus by the elongation of the middle region of the body, whereas in *Byssarca* and *Barbatia* these organs are comparatively less elongated, the elongation

Text-figure 4.

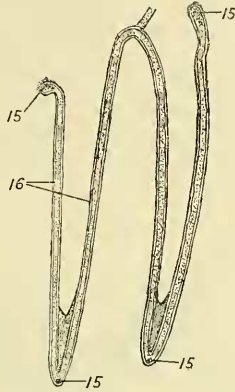
Heart (from the dorsal aspect) of *S. celox*.

being mainly exhibited in the posterior retractor pedis muscles. In *Acar* the body seems to be equally elongated in the middle region (the above-mentioned parts being affected) and in the posterior region beyond the posterior adductor, the mantle only being affected. The elongation of the posterior region of the body is thus greatest in *Acar*, least in *Byssarca*, and attains an intermediate condition in *Scaphula*. With regard to the heart of *Scaphula*, we find an intermediate condition of the ventricles between *Byssarca* (with a wide separation of the ventricles) and *Barbatia* (in which they are only slightly separated), but marked difference from *Acar*, which has a single, but distinctly, bilobed ventricle. The position of the heart in relation to the rectum might have been derived from a condition seen in the above genera. Lastly, the projecting portion of the rectum seems

\* This is not referred to elsewhere.—ED.

to bring the anus directly in the line of the outward current of water and the exhalant aperture, and this is perhaps correlated with the depth of the posterior region below and behind the posterior adductor. In *Acar* the great depth of the mantle is attended by a great elongation of the projecting tube of the

Text-figure 5.

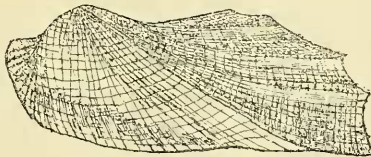
A gill-filament of *S. celox* (outer and inner demibranch).

rectum. In conclusion it might be noted that the present genus might have originated amongst and be related to *Byssarca* and *Barbatia*, although modified and perhaps degenerate owing to its fluviatile life.

#### SCAPHULA MINUTA, sp. n.

Specimens of this species were collected by Dr. N. Annandale, who kindly gave me the following information:—The species occurs all over the Tale Sap or Inland Sea of Singgora on the

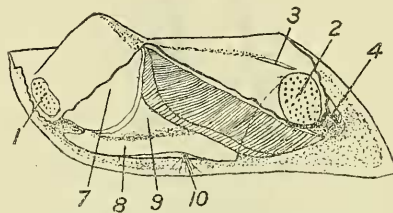
Text-figure 6.

Shell of *S. minuta*, outer surface (left valve).

east coast of peninsular Siam. It was found attached to weeds and stones in both fresh and brackish water. The specimens I have examined were found adhering to water-plants by several byssus threads.

*Shell*.—Minute, elongated, thin, closed and deep posteriorly. Anterior margin slightly convex, and sloping backwards from above and continuous with the ventral margin. Ventral margin slightly convex in front, straight or very slightly convex behind and somewhat sloping downwards. Posterior margin convex and sloping downwards and backwards. Ligamentous area small, narrow, triangular in front of and broadly club-shaped behind the umbones. Ligament lozenge-shaped and occupying the anterior and a small area of the posterior portion of the ligamentous area, and half the length of the entire ligamentous area. Hinge teeth numerous. Central teeth obsolete. Four or five lateral teeth, oblique in direction. Three posterior lateral teeth elongated and very oblique. Surface with a thin, light-brown epidermis. Diagonal ridge very prominent. Surface in

Text-figure 7.

Animal of *S. minuta*, side view (left).

front of the ridge convex, and with fine radiating and horizontal lines intersecting one another. Surface behind the ridge concave, and with four stout radiating ridges in addition to minute, closely placed similar lines all intersected by vertical ones. Length 4.5 mm., height 2 mm., trans. diam. 2 mm.

The present species differs from the three other known species of *Scaphula*, Benson in its minute size, in the slight tumidity of the valves (the proportion of the vertical diameter to the transverse diameter being 1:2), and in the comparative shortening of the body in the antero-posterior diameter.

The type-specimens are kept in the Indian Museum.

#### *Explanation of Text-figures 1-7.*

1. Anterior adductor muscle. 2. Posterior adductor muscle. 3. Posterior retractor pedis muscle. 4. Free end of the rectum. 5. Stomach. 6. Outline of the liver. 7. Labial palp. 8. Foot. 9. Visceral mass. 10. Byssus threads. 11. Ventral fissure of the foot. 12. Ventricle. 13. Auricle. 14. Rectum. 15. Ciliary discs. 16. Filament of inner demibranch.